

# **COOLING TECHNOLOGY INSTITUTE**

## **MULTI-AGENCY TESTING PROGRAM**

### **2017 ANNUAL REPORT**



**Prepared by:**

**THE MULTI-AGENCY TESTING COMMITTEE**

**Frank Michell, Chair  
Rich Aull, Vice Chair  
Paul Lindahl, Vice Chair**

**For:**

**The Cooling Technology Institute  
P.O. Box 681807  
Houston, Texas 77268**

**February 5, 2018**

## 1.0 Introduction

### 1.1 Background

For over sixty years, the Cooling Technology Institute (CTI) has provided cooling tower performance testing services to members and non-members alike. Starting in January 1993, the CTI has provided these testing services through several testing agencies, each examined, qualified, and licensed by the CTI to conduct such tests. The documents establishing the program, and under which it currently operates, were developed by a task force under the auspices of the CTI Performance & Technology Committee. Currently, five agencies are licensed to conduct thermal performance tests -- CleanAir Engineering, Inc.; Cooling Tower Testing Associates, Inc.; Cooling Tower Technologies Pty. Ltd.; McHale & Associates, Inc.; and DMT GmbH & Co. KG. Two agencies are licensed to conduct drift testing -- CleanAir Engineering, Inc.; and McHale & Associates, Inc. Two agencies are licensed to conduct sound testing – CleanAir Engineering, Inc., and McHale & Associates, Inc., For additional information on the licensed test agencies as of January 1, 2018, addresses, and whom to contact, please see Appendix A.

### 1.2 Organization

The program is administered by the CTI Multi-Agency Testing Committee, which works closely with the licensed agencies to ensure tests bearing the CTI name are conducted by qualified, impartial personnel; using good, calibrated instrumentation; in full compliance with the intent of the applicable CTI codes and standards.

The licensed agencies operate in accordance with a License Agreement, which includes a Testing Manual prepared specifically for this program. The first level of oversight for the general operation of the program is the Thermal Testing Program Committee, which is comprised of the licensed thermal testing agencies and includes the chair of the Multi-Agency Testing Committee and the chair of the Performance and Technology Committee as non-voting members. This committee also provides a forum where the licensed agencies can discuss, and hopefully resolve among themselves, any technical or administrative problems that may arise.

The resolution of questions regarding the activities of the licensed testing agencies falls to either of two CTI committees:

- a) Technical issues regarding the interpretation of test codes and the Testing Manual are the province of the Performance and Technology Committee and the Multi-Agency Testing Committee.
- b) The Multi-Agency Testing Committee is responsible for the administration of the license agreements.

The Multi-Agency Testing Committee, supported as necessary by the Performance and Technology Committee, maintains the License Agreement Testing Manual, screens potential new agencies, and conducts technical audits of agencies as required. The Multi-Agency Testing Committee has responsibility for business related audits of new and current agencies, and coordinates the activities of the Thermal, Drift and Sound Testing Program Committees. It should be emphasized that these review and oversight activities are in no way permitted to compromise the confidential aspects of individual tests.

Although the Multi-Agency Testing Committee and the P & T Committee are available to assist in the resolution of any questions concerning interpretation and implementation of CTI Codes and Standards as they may pertain to a specific test, such involvement is provided only at the request of **all** the official parties to the test.

CTI endeavors to meet the testing needs of the worldwide cooling tower industry, including tower users, manufacturers, contractors, and suppliers. The Thermal, Drift and Sound Testing Program Committees, chaired by the chair of the Multi-Agency Testing Committee, work to ensure the needs of the users of the CTI testing services are being met.

The Multi-Agency Testing Committee is structured with a Chair and two Vice Chairs. The User, Supplier and Manufacturer categories of the CTI membership are each represented, assuring that at least one of the three is likely to be free of a conflict of interest in any specific situation.

## **2.0 Testing Services**

### **2.1 General**

The CTI currently offers the following tower testing services as part of the Multi-Agency Testing Program:

- Thermal Performance Acceptance Testing.
- Thermal Certification Testing
- Thermal Performance Status Testing.
- Special Tests.
- Drift Testing.
- Sound Testing.

Agencies licensed under the Thermal Testing Program may conduct acceptance, performance status, and special thermal testing. Acceptance and performance status tests are generally conducted in accordance with CTI ATC-105, although tests may be conducted using another thermal testing code with the consent of all the parties to the test. Special testing includes any sub-part of testing according to CTI ATC-105. A parallel licensing program for Drift Testing is in place, with testing conducted in accordance with CTI ATC-140.

Information on testing services can be obtained from the CTI office in Houston or from any of the licensed CTI testing agencies. When an inquiry for a specific test is received at the CTI office, a list of the licensed agencies, including a brief summary of their capabilities, is provided. A copy of the agency information summary, current as of the date of this report, is included in Appendix A. Potential clients contact the agency of their choice to obtain pricing and scheduling information. When requested, the agency sends a copy of CTI FSP-156, *Preparation for an Official CTI Thermal Performance, Plume Abatement, or Drift Emission Test*. After the test has been conducted by the CTI agency selected by the customer, a report number is issued by the CTI office and a final report is sent to the parties to the test.

The Multi Agency Testing Program includes reporting custom cooling tower acceptance test results in accordance with the provisions of CTI STD-202. This Standard is a voluntary program wherein CTI will publish measurements of the thermal performance test history of participating tower manufacturers which is posted on the CTI website (CTI.org) and in the CTI Journal.

**2.2 Thermal Performance Acceptance Testing, Thermal Certification and Performance Status Testing**

Thermal performance acceptance and performance status tests of natural draft and mechanical draft, evaporative and wet/dry cooling towers, and closed circuit cooling towers are conducted under the provisions of CTI ATC-105, *Acceptance Test Code for Water-Cooling Towers* or Supplement to ATC-105, *Acceptance Test Code for Closed Circuit Cooling Towers*, CTI ATC-106, *Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers*, unless otherwise specified by the parties to the test. An acceptance test is conducted on a new or refurbished tower to determine if the performance meets the manufacturer’s contractual guarantee. The Licensed Testing Agency is required to assure that the tower manufacturer and tower purchaser are given sufficient notice to witness the acceptance test and the collected test information is distributed to both parties. If a thermal performance test is not being conducted to determine compliance with a contractual guarantee, it is considered a performance status test. Additional requirements for Thermal Certification Tests are included in CTI STD-2010M & CTI STD-201RS.

**2.3 Drift and Sound Testing**

Drift testing is conducted in accordance with CTI ATC-140, *Isokinetic Drift Measurement Test Code for Water Cooling Towers*, unless otherwise specified by the parties to the test. Sound testing is conducted in accordance with CTI ATC-128, *Measurement of Sound From Water-Cooling Towers*. As with thermal tests, drift and sound tests may be either acceptance or status tests.

**2.4 Special Tests**

Special tests include any tests which can be conducted using a portion of ATC-105 without determining tower capacity. An example is measurement of water flow rate by Pitot traverse.

**2.5 Other, Non-licensed Testing**

CTI test codes exist for other types of testing, such as Plume Abatement (ATC-150). Testing according to other CTI test codes are not subject to the license and are available outside the CTI Licensing Program.

**3.0 CTI Testing Activities for 2017**

In calendar year 2017, a total of 58 thermal tests were conducted. Note: Thermal Certification Tests are not included in the tables below. A distribution of the tests by type is shown in Table 1 below.

**Table 1. Distribution of Tests by Type**

	2017	2016	2015	2014	2013
Acceptance – New	35	31	34	25	33
Acceptance -- Refurbished	8	5	10	10	14
Acceptance – Total	43	36	44	35	47
Performance – New	1	2	1	0	3
Performance – Refurbished	6	2	6	3	8
Performance – Old	8	10	6	21	24
Performance – Total	15	14	13	24	35
Special	0	5	2	4	0
Grand Total (Thermal Tests)	58	55	59	63	82

The overall average of the Tower Capabilities, the maximum and minimum capabilities, and the number of tests with one or more parameters out of code are shown for each type of test in Table 2 below. **Note that Parameters out of code are calculated based on all tests in the category, with or without a result calculated as being out of code may be the cause for non-calculation of a result.**

**Table 2. Summary of 2017 Thermal Test Results**

Type of Test	# Tests	% Tower Capability				Parameters out of Code				
		Max	Avg.	Med.	Min.	0	1	2	3	4
Acceptance – New	35	131.0	101.5	100.2	76.0	10	19	15	3	1
Acceptance -- Refurb.	8	130.0	111.1	104.0	101.1	2	5	1	1	0
Acceptance – All	43	131.0	103.3	101.0	76.0	12	29	19	4	1
Performance – New	1	0	0	0	0	0	0	1	0	0
Performance – Refurb.	6	147.0	106.6	99.1	81.0	0	4	2	0	0
Performance – Old	8	100.3	79.1	90.9	42.0	2	9	9	3	0
Performance – All	15	147.0	89.1	91.0	42.0	2	13	12	3	0
Overall	58	147.0	100.1	100.3	42.0	14	42	31	7	1

The number of tests (expressed as a percentage) with any particular parameter out of code are shown in Table 3 below for each type of test and overall. The parameter most often out of code was fan power, , followed by cooling range.

**Table 3. Test Parameters Out of Code – Percentage of Tests (with or without calculated result)**

Type of Test	Wet Bulb	Range	Flow	Fan HP	Wind	Dry Bulb
Acceptance – New % of Tests	8%	25%	21%	46%	27%	2%
Acceptance – Refurb. % of Tests	22%	44%	22%	22%	0%	0%
Performance – New % of Tests	100%	0%	0%	0%	0%	100%
Performance – Refurb. % of Tests	0%	33%	33%	67%	0%	0%
Performance – Old % of Tests	9%	35%	22%	48%	39%	4%
All Tests % of Tests	9%	28%	21%	0%	32%	3%

The thermal test results are shown graphically in several figures. The graphs included in this Report reflect data from tests where a result was reported. The thermal acceptance test results for new cooling towers are shown on Figure 1 as a function of the design circulating water flow rate.

The Multi-Agency reporting for the STD-202 program is in Table 4.

**Table 4 Multi-Agency Reporting for STD-202**

	All Multi-Agency Acceptance Tests	
Testing during the period:	2017	2016
Percentage of tests at or above 100% Capability	56%	62%
Percentage of tests at or above 95% capability	79%	82%
Average Capability of tests results below 95%	87%	89%
Average Water Flow Rate (gpm)	27038	58583

The performance test (tests performed without contractual guarantee compliance determination) results are shown on Figure 3. The combined thermal test results for all thermal tests are shown on Figure 4. A historical overview of the thermal performance testing is shown on Figure 5.

The CTI Office requested feedback from each test representative party to each test performed by the licensed test agencies. Completed surveys received by the CTI Office were positive.



Figure 1

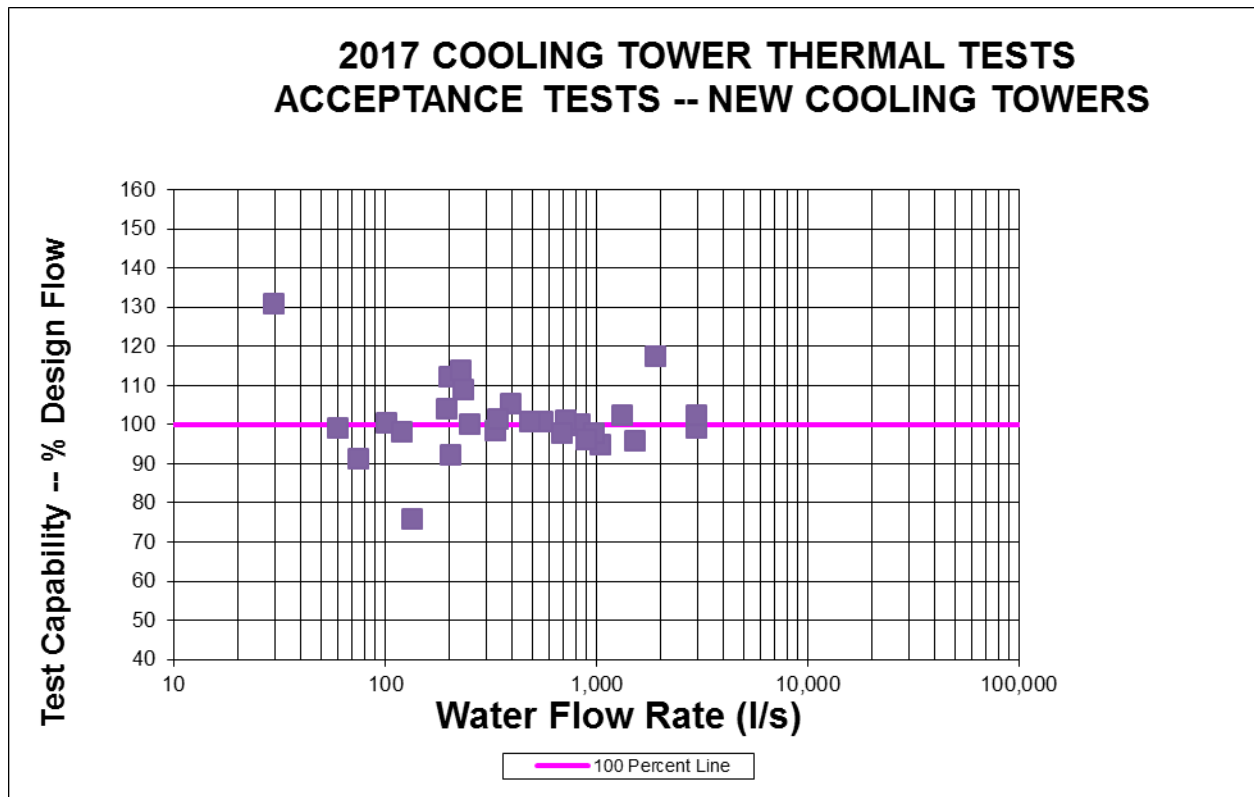


Figure 2

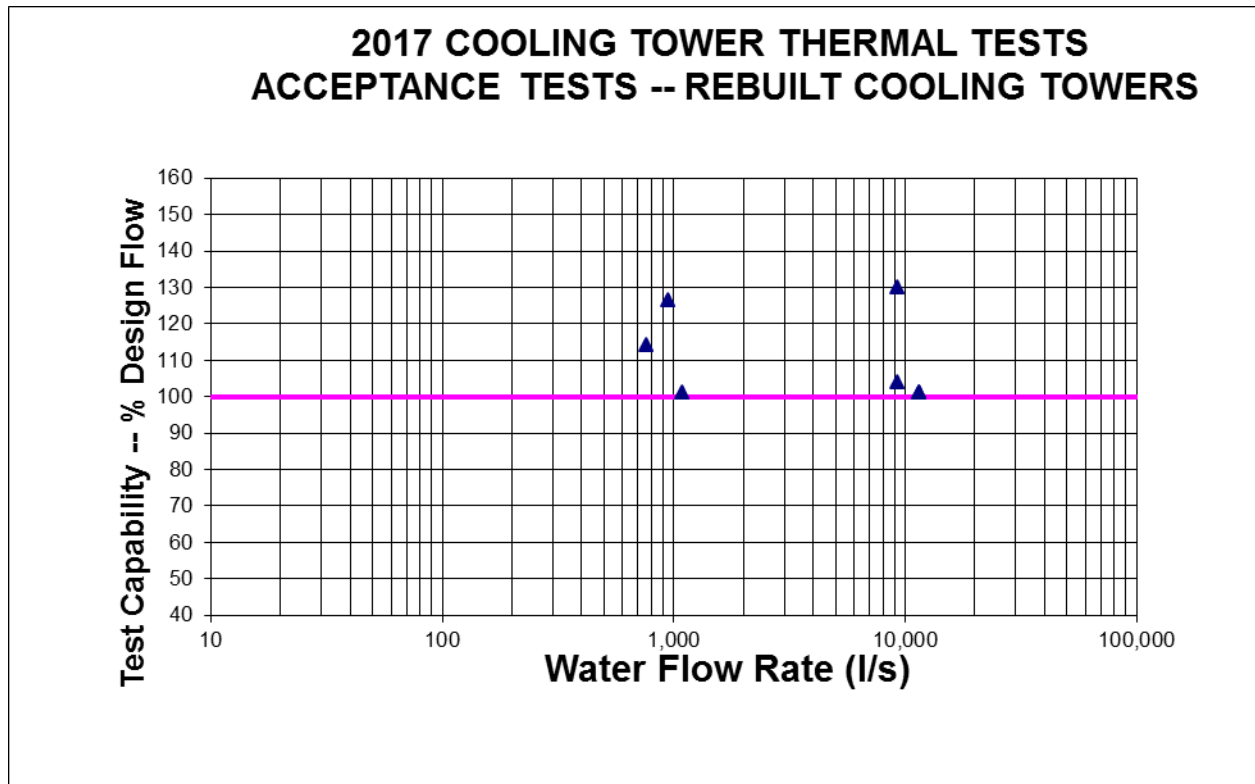


Figure 3

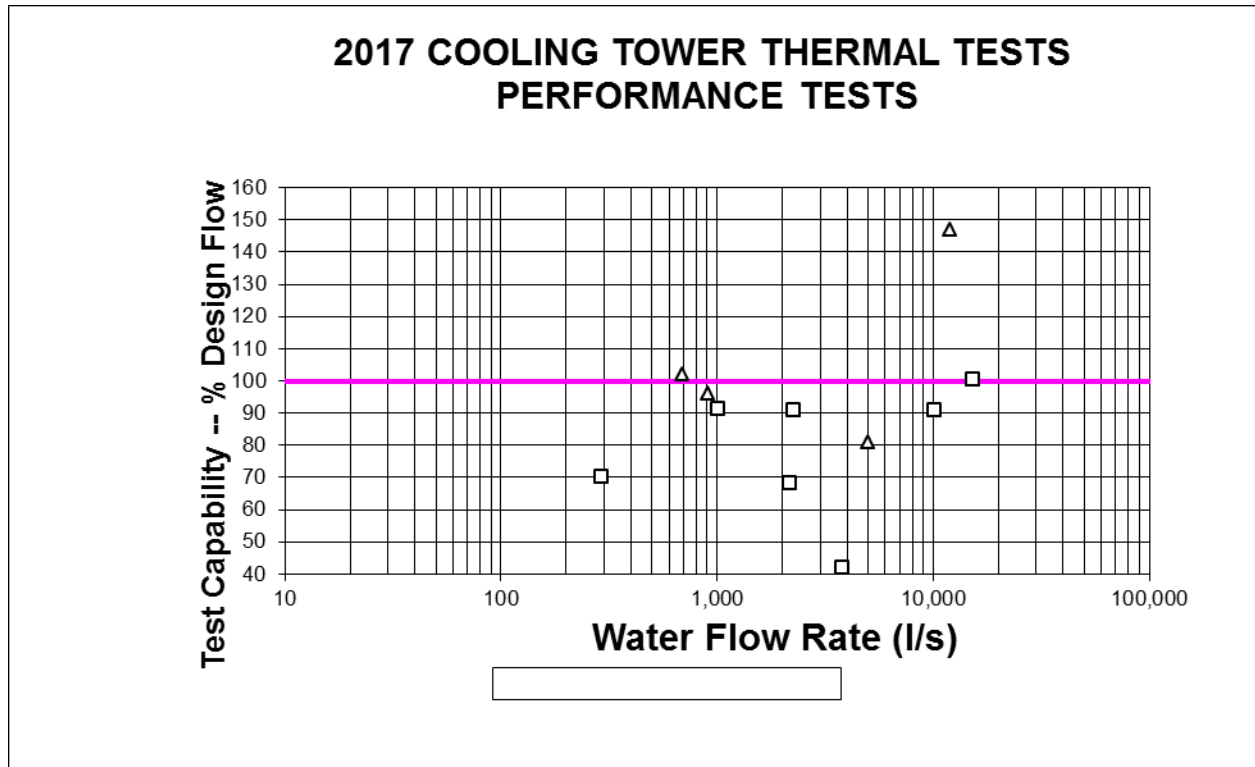


Figure 4

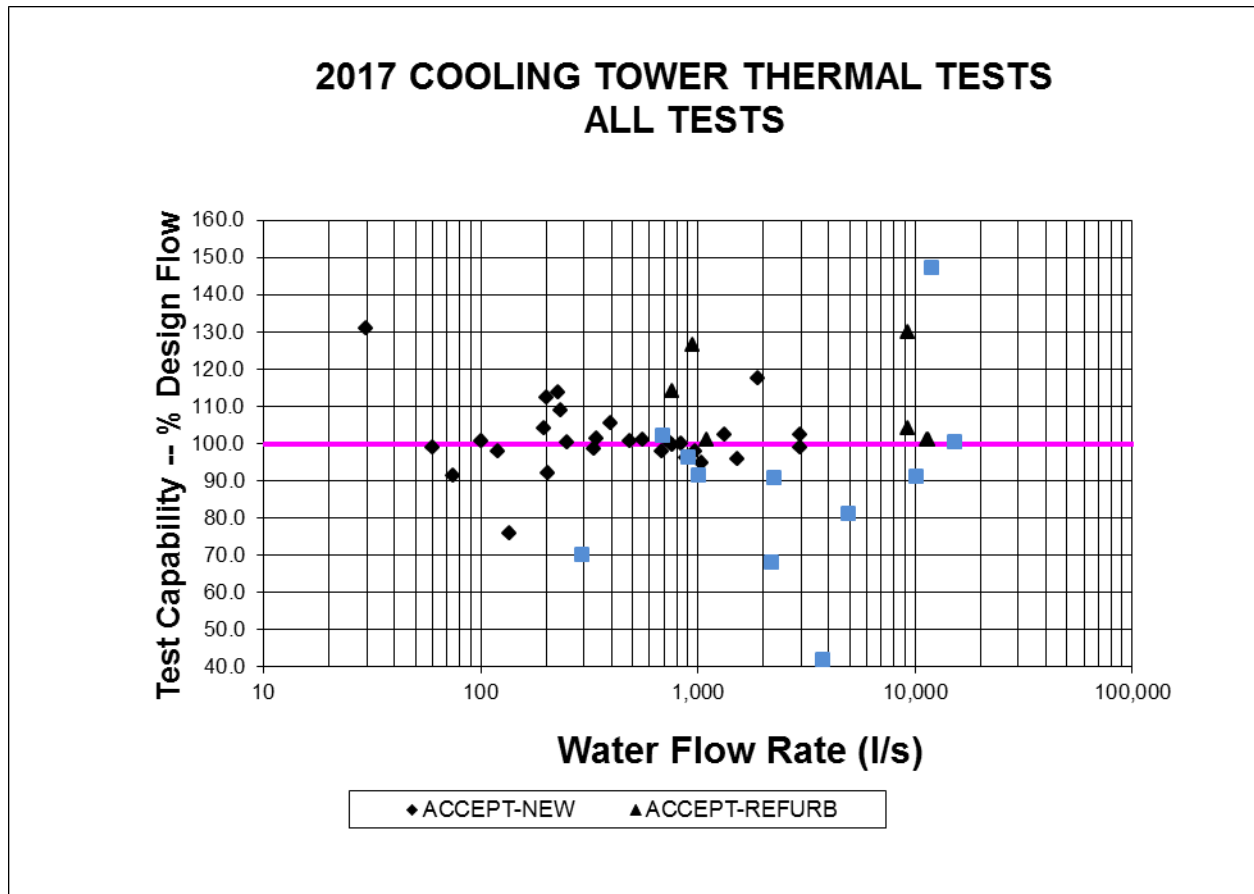
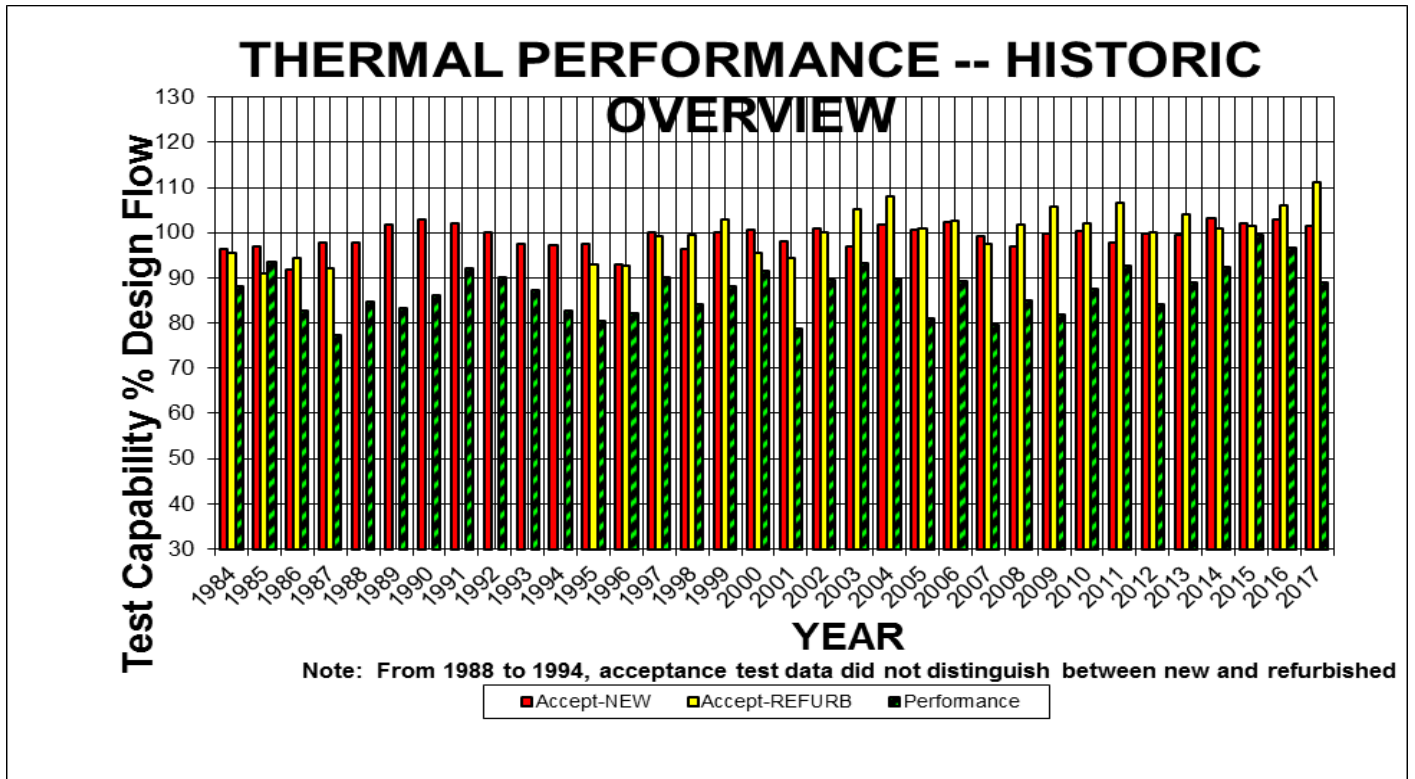
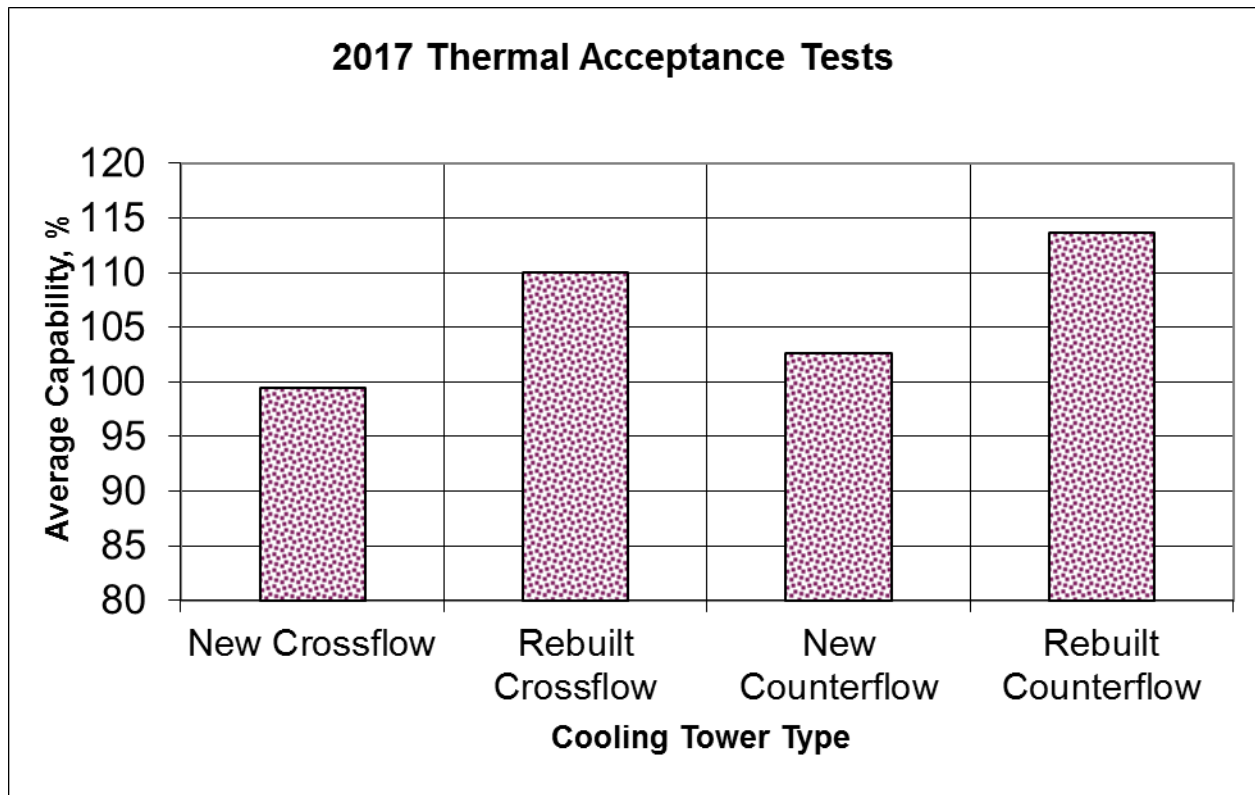


Figure 5



**Figure 6**



**APPENDIX A**

## CTI Licensed Thermal Testing Agencies

Effective 1/1/2018

License Type*	Agency Name	Address	Contact Person / E-mail / Web site	Telephone Number	FAX Number
A, B	<b>Clean Air Engineering, Inc.</b>	7936 Conner Rd Powell, TN 37849 U.S.A.	Kenneth Hennon <a href="mailto:khennon@cleanair.com">khennon@cleanair.com</a> <a href="http://www.cleanair.com">www.cleanair.com</a>	(865) 938-7555 Or (800) 208-6162	(865) 938-7569
A, B	<b>Cooling Tower Technologies Pty. Ltd.</b>	PO Box 4157 Bexley North, NSW 2207 AUSTRALIA	Ronald Rayner <a href="mailto:coolingtwrtech@bigpond.com">coolingtwrtech@bigpond.com</a> <a href="http://www.coolingtwrtech.com">www.coolingtwrtech.com</a>	61 2 9789 5900	61 2 9789 5922
A, B	<b>Cooling Tower Test Associates, Inc.</b>	15325 Melrose Drive Stanley, KS 66221 U.S.A.	Thomas E. Weast <a href="mailto:cttake@aol.com">cttake@aol.com</a> <a href="http://www.cttai.com">www.cttai.com</a>	(913) 681-0027	(913) 681-0039
A, B	<b>McHale &amp; Associates, Inc.</b>	4700 Coster Road Knoxville, TN 37912 U.S.A.	Jared Medlen. <a href="mailto:ctitesting@mchale.org">ctitesting@mchale.org</a> <a href="http://www.mchaleperformance.com">www.mchaleperformance.com</a>	(865) 588-2654	(865) 934-4779
A,B	<b>DMT GmbH &amp; Co. KG</b>	Am Technologiepark 1 45307 Essen, Germany	Dr Meinolf Gringel <a href="mailto:Meinolf.Gringel@dm-group.com">Meinolf.Gringel@dm-group.com</a> <a href="http://www.dmt-group.com">www.dmt-group.com</a>	49 201 172 1164	49 201 172 1606

\* Type A license is for the use of mercury-in-glass thermometers; typically used for smaller towers.

Type B license is for the use of remote data acquisition devices, which can accommodate multiple measurement locations required by larger towers.



## CTI Licensed Drift Testing Agencies

Effective 1/1/2018

Agency Name	Address	Contact Person / E-mail / Web site	Telephone Number	FAX Number
<b>Clean Air Engineering, Inc.</b>	7936 Conner Rd Powell, TN 37849 U.S.A.	Kenneth Hennon <a href="mailto:khennon@cleanair.com">khennon@cleanair.com</a> <a href="http://www.cleanair.com">www.cleanair.com</a>	(865) 938-7555 Or (800) 208-6162	(865) 938-7569
<b>McHale &amp; Associates, Inc.</b>	4700 Coster Road Knoxville, TN 37912 U.S.A.	Jared Medlen. <a href="mailto:ctitesting@mchale.org">ctitesting@mchale.org</a> <a href="http://www.mchaleperformance.com">www.mchaleperformance.com</a>	(865) 588-2654	(865) 934-4779

## CTI Licensed Sound Testing Agencies

Effective 1/1/2018

Agency Name	Address	Contact Person / E-mail / Web site	Telephone Number	FAX Number
<b>Clean Air Engineering, Inc.</b>	7936 Conner Rd Powell, TN 37849 U.S.A.	Kenneth Hennon <a href="mailto:khennon@cleanair.com">khennon@cleanair.com</a> <a href="http://www.cleanair.com">www.cleanair.com</a>	(865) 983-7555 Or (800) 208-6162	(865) 938-7569
<b>McHale &amp; Associates, Inc.</b>	4700 Coster Road Knoxville, TN 37912 U.S.A.	Jared Medlen. <a href="mailto:ctitesting@mchale.org">ctitesting@mchale.org</a> <a href="http://www.mchaleperformance.com">www.mchaleperformance.com</a>	(865) 588-2654	(865) 934-4779

## Data on CTI Licensed Thermal Testing Agencies

Effective 1/1/2018

Agency Name	Licensed Testing Agency Since	Number of Lead Testers**	Number of Data Loggers**	Pipe Diameters covered by Pitot Tubes	Total Number Wet Bulb Instruments	Geographic Preference
CleanAir Engineering, Inc.	2006	10	>30	150 – 5260 mm (6" – 207")	>150	Worldwide
Cooling Tower Technologies Pty. Ltd.	2004	2	4	150 - 3600 mm (6" - 142")	40	Worldwide
Cooling Tower Test Associates, Inc.	1997	2	9	50 - 4265 mm (2" - 168")	60	Worldwide
McHale & Associates, Inc.	2006	10	50	150 - 5500 mm (6" - 216")	>150	Worldwide
<b>DMT GmbH &amp; Co. KG</b>	2017	2	7	50 - 4265 mm (2" - 168")	18	Worldwide

\*

\*\* Maximum number of concurrent tests will be limited by the number of lead testers and/or the number of data loggers.

## Data on CTI Licensed Drift Testing Agencies

Effective 1/1/2018

<b>Agency Name</b>	<b>Licensed Testing Agency Since</b>	<b>Number of Lead Testers*</b>	<b>Number of Drift Sampling Trains*</b>	<b>Geographic Preference</b>
CleanAir Engineering, Inc.	2006	6	5	Worldwide
McHale & Associates, Inc.	2006	10	5	Worldwide

\* Maximum number of concurrent tests will be limited by the number of lead testers and/or the number of drift sampling trains.

**Data on CTI Licensed Sound Testing Agencies**

Effective 1/1/2018

<b>Agency Name</b>	<b>Licensed Testing Agency Since</b>	<b>Number of Lead Testers*</b>	<b>Maximum Concurrent Test Capability</b>	<b>Geographic Preference</b>
CleanAir Engineering, Inc.	2015	6	6	Worldwide
McHale & Associates, Inc.	2015	6	6	Worldwide

*\* Maximum number of concurrent tests will be limited by the number of lead testers and/or availability of required instrumentation..*